Proposal for Placement Alternatives

Lakes Shafer and Freeman Lake Dredging Project White County, Indiana

For

Early Environmental Coordination

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And

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Introduction

The Shafer and Freeman Lakes Environmental Conservation Corporation (SFLECC) is planning to dredge Lake Shafer in the coming years. They have made a bathymetric survey of both Lakes Shafer and Freeman and have been working diligently on acquiring upland properties to be used for dewatering and (disposal) placement sites for the dredged sediments.

The SFLECC has targeted Lake Shafer initially, because it has the most serious siltation problem. Some properties have been acquired, but they are now at a point where it is becoming difficult to obtain additional land from the property owners. Lake Shafer is long and narrow with nearly 10 miles of waterway. Dredging sediments via hydraulic dredging is the preferred and most effective method of sediment removal. However, it is not practical to pump these sediments for 8 to 10 miles to an upland site without a series of booster pumps to overcome the friction loss in the pipeline, let alone the added height to pump up to the upland site.

Dredge operators cannot merely apply a greater horsepower to pump a longer distance. What happens is that while they may obtain a greater velocity, more water than sediments will be pumped, and the net production will decrease. The other problem the SFLECC may face is not finding any contractors who have a large enough dredge to pump material far enough. We already had complaints from bidders of past Lake Shafer dredging projects on having to pump just 4,000 feet.

Proposed Plan

The SFLECC would like to investigate the possibility of placing hydraulically dredged sediments into lake and backwater areas of Lake Shafer and Big Monon Creek (Bay) by constructing berm structures and using the resulting impoundments to dewater the sediments and create islands, peninsulas, and wetland/ wildlife habitats. The dikes or breakwaters would be created by using dredged materials, bioengineering materials (plant and other woven materials), and pumped sediment-filled geotextile tubes known as "geobags" or "geotubes".

Other possible options we want to consider is pumping dredged sediments directly into the lake areas where we want to create these island or peninsula areas, with the use of silt curtains as needed. Dredging and sediment placement activities are not long-term events. Therefore, settlement of solids and some of the finer clayey materials will likely settle out before they become an environmental problem.

The size of the islands or peninsulas would need to be 5 acres or more and constructed above he high water elevation in order to protect the site. Such areas would be graded flat enough for wildlife to use and might contain internal ponds and surrounding ground cover for possible nesting areas.

Targeted Areas

The SFLECC has acquired two upland sites for sediment placement. One is a 68+ acre site located South of Hoagland Bay West of Lake Shafer as shown on the attached 7 ½ minute quadrangle exhibit. They have also acquired another 31+ acre site located north of Keans Creek East of Lake Shafer. The 68 acre site is about ½ mile from Lake Shafer. The 31 acre site is nearly 2 miles from Lake Shafer.

Other sites would consist of constructed islands or peninsulas as described above. They would include areas within a finger lake backwater part of Lake Shafer near the North end of the lake North of CR 775 N as shown on the exhibit. Other possible areas would include the embayment areas of Big Monon Creek, one approximately a mile above Lake Shafer. Another possible area is known as North Bedford Bay located on the Big Monon Creek north of Monon Road. The embayment area in McKillip Ditch located west of CR 350 East is another possible area. Each of these sites are identified on the attached exhibit topo map.

Project Name: TENNESSEE-TOMBIGBEE WATERWAY HABITAT DEVELOPMENT

Corps Division: SAD

Project Type: restoration and intensive management of dredged material sites for waterfowl habitat, food crops for wildlife, reforestation, and other wildlife-related activities

Project Size: 14,000 acres of confined disposal sites

Project Location: in western Mississippi and southeastern Alabama, connecting the Tennessee River through the Yellow Creek Divide to the Tombigbee River system

Substrate Type: silt and sand dredged material

Energy Sources: minimal

Protection Provided: none

Vegetation Used: varies from site to site, but in general includes management systems where marsh seeds are planted and food made available through water level manipulation, or ponding for overwintering waterfowl, or planting of food crops especially for deer, turkey, quail, small mammals, and songbirds

Project Constructed: 1980s

Monitoring: Engineering monitoring by Mobile District and WES; biological monitoring joint effort of Mobile District, WES, Mississippi State University, Mississippi Dept. of Wildlife Conservation, and Alabama DNR. The entire TTWW project includes 72,400 acres of Corps-owned land that is intensively managed for wildlife and fisheries, 14,000 of which are dredged material sites. This is a showcase project, with heavy recreational potential and utilization. An extensive blue bird and wood duck/hooded merganser nesting box program has been in place for nearly 10 years.

Success or Failure: highly successful

Costs: (Jim Baxter and Skeeter McClure have this information)

POC(s): Jim Baxter, Skeeter McClure, and Danny Hartley, Mobile District; Dr. Ed Hill, Mississippi State University; Ed Hackett, Mississippi Dept. of Wildlife Conservation; Dr. Jim Pennington, Dr. Drew Miller, and Dr. Mary Landin, WES

Project Name: FOLLY RIVER BIRD ISLAND RESTORATION

Corps Division: SAD

Project Type: renourishment of nesting island using maintenance dredged material

Project Size: less than 20 acres

Project Location: Charleston County Park, Folly River, Charleston, SC

Substrate Type: silt and sand dredged material

Energy Sources: minimal

Protection Provided: none

Vegetation Used: natural colonization

Project Constructed: 1980s

Monitoring: Engineering monitoring by Charleston District; biological monitoring joint effort of local birders and Charleston District. Dredged material was used to protect and expand an existing nesting area and a county park.

Success or Failure: success

Costs: $2.28 per cubic yard

POC(s): Jim Woody and Braxton Kyzar, Charleston District

Project Name: WEAVER BOTTOMS WETLAND RESTORATION PROJECT

Corps Division: NCD

Project Type: fresh marsh and riparian restoration using dewatered maintenance dredged material for structural support and erosion control

Project Size: 5000 acres

Project Location: Upper Mississippi River National Fish and Wildlife Refuge Complex, Winona, Minnesota

Substrate Type: sand dredged material

Energy Sources: river currents, long wind fetch across Pool 5 of the Upper Mississippi River Lock and Dam System

Protection Provided: dredged material itself is the structure

Vegetation Used: none

Project Constructed: 1988

Monitoring: Pre-, during, and post-construction monitoring a joint effort of St. Paul District, FWS, State of Minnesota, and State of Wisconsin. Monitoring includes water quality, fish, vegetation, wildlife, and other parameters. Dredged material was used to plug eroded channels that were causing washout of fresh marsh within Weaver Bottoms, and to build waterfowl nesting islands that would also help break up wind fetch.

Success or Failure: mixed success; vegetation is not recovering as expected due to unknown factor unrelated to the project; islands were built with too steep sides and are eroding

Costs: $2 to $4 less than all other dredged material placement options, with substantial cost savings over life of project

POC(s): Robert Whiting and Dennis Anderson, St. Paul District; Richard Berry, Upper Mississippi River NWR Complex manager, Winona, MN; Dr. John Barko, FWS; Scott Hausmann, Wisconsin DNR

Project Name: WINE ISLAND BARRIER ISLAND RESTORATION

Corps Division: LMVD

Project Type: restoration of a portion of the barrier island system in southern Louisiana using dredged material

Project Size: 21 acres

Project Location: at Wine Island, Houma Navigation Canal, Terrebonne Parish, LA

Substrate Type: 6000 CY of silt and sand dredged material contained by a rock dike

Energy Sources: barge and boat wakes, natural wave energies, subsidence

Protection Provided: rock dike used to hold material in place

Vegetation Used: smooth cordgrass and other typical marsh grasses to be planted

Project Constructed: 1991

Monitoring: Pre-, during, and post-project monitoring conducted by New Orleans District and Louisiana DNR, with input from other agencies. Plan is to restore part of the eroding/subsiding barrier island system in Louisiana using maintenance dredged material.

Success or Failure: under construction

Costs: $47,952 per acre

POC(s): Sue Hawes and Dr. Linda Glenboski, New Orleans District; Dr. Bill Good, Louisiana DNR

Project Name: QUEEN BESS ISLAND WATERBIRD NESTING/MARSH CREATION SITE

Corps Division: LMVD

Project Type: marsh creation and pelican nesting island expansion using maintenance dredged material

Project Size: 8 acres

Project Location: GIWW, Barataria Bay, southern Louisiana

Substrate Type: silty sand dredged material

Energy Sources: barge and boat wakes, limited wind fetch, some natural wave energies

Protection Provided: none

Vegetation Used: natural colonization (vegetation not encouraged on nesting areas)

Project Constructed: 1980s

Monitoring: All monitoring being done by New Orleans District and Louisiana DNR. Dredged material was used to expand and preserve existing brown pelican nesting sites. Marsh was created adjacent to island to protect it from erosion.

Success or Failure: success

Costs: $70,156 per acre

POC(s): Sue Hawes and Scott Clark, New Orleans District; Dr. Bill Good, Louisiana DNR

Project Name: MOBILE BAY UNDERWATER BERM PROJECT

Corps Division: SAD

Project Type: construction of deepwater and nearshore berms using dredged material

Project Size: berms several acres each in size

Project Location: Gulf of Mexico off entrance to Mobile Bay, Alabama

Substrate Type: silt and sand dredged material

Energy Sources: full wind and wave energies of the Gulf of Mexico

Protection Provided: none

Vegetation Used: none, not applicable

Project Constructed: 1987-1988

Monitoring: Pre-, during, and post-construction monitoring conducted by Mobile District and WES, with EPA and NMFS evaluating each data sample. Deepwater berm was constructed to be stable, to provide storm surge protection. Nearshore berm was constructed to be mobile, to nourish the beaches near the entrance to Mobile Bay. Movement, configuration, fish use, water quality, and other parameters are being monitored.

Success or Failure: Success; berms are at this time performing exactly as designed and implemented.

Costs: (Dr. Hands has this information)

POC(s): Dr. Ed Hands and Dr. Doug Clarke, WES; Dr. Sue Rees, Mobile District; Dr. Neil McLellan, Galveston District

Project Name: SLAUGHTER CREEK OYSTER REEF RESTORATION

Corps Division: NAD

Project Type: oyster reef development using dredged material capped with old oyster cultch

Project Size: less than 5 acres

Project Location: Slaughter Creek, Chesapeake Bay, Maryland

Substrate Type: silty sand dredged material

Energy Sources: long wind fetch and wave energies from all sides

Protection Provided: oyster shell capping

Vegetation Used: none (not applicable)

Project Constructed: 1989

Monitoring: Pre-, during, and post-project monitoring conducted by Baltimore District, WES, and NMFS.

Success or Failure: successful, and a similar project will be carried out in another location in 1991

Costs: (Bob Blama has these costs)

POC(s): Robert N. Blama, Baltimore District; Dr. Doug Clarke, WES; Mark Fonseca, NMFS

Project Name: MISSION BAY SEAGRASS RESTORATION PLANTINGS

Corps Division: SPD

Project Type: seagrass restoration using dredged material substrates

Project Size: more than 200 acres

Project Location: in Mission Bay Park, San Diego, California

Substrate Type: sand dredged material

Energy Sources: minimal wind and wave energies, limited impacts by local boaters and recreationalists

Protection Provided: none

Vegetation Used: eelgrass

Project Constructed: 1980s

Monitoring: Pre-, during, and post-planting monitoring conducted by the contractor hired to plant the site. Monitoring is continuing to document spread of the original planting of several acres that is now covering most of 200 acres of protected coves and lakes within the Mission Bay Park, which was constructed entirely of dredged material.

Success or Failure: success

Costs: costs of dredging part of project; costs of planting eelgrass was less than $5000 per acre

POC(s): Dr. Keith Merkel, Pacific Laboratories, National City, CA; Mission Bay Park office; Dr. Mary Landin and Dr. Doug Clarke, WES

Project Name: MORE THAN 400 ATLANTIC COAST WATERBIRD NESTING DREDGED MATERIAL ISLANDS

Corps Division: SAD, NAD, NED

Project Type: wildlife islands built using dredged material

Project Size: varies from 0.5 acres to over 100 acres

Project Location: most islands are located in the Atlantic Intracoastal Waterway adjacent to the channel from Florida to Long Island, in Chesapeake Bay, or in major harbor areas (Savannah, Charleston, Norfolk, Philadelphia, New York

Substrate Type: most are sand or silty sand, although those in harbors contain more silt

Energy Sources: wind fetches and wave energies vary; all are affected to some extent by barge and boat wakes

Protection Provided: most older islands, none; newer islands and CDFs, riprap or some other protective structure

Vegetation Used: all AIWW islands colonized naturally with the exceptions of Core Sound and Barren Island, which had shorelines planted with cordgrass

Project Constructed: most constructed when AIWW was built in 1930-1940s

Monitoring: Islands in New Jersey, North Carolina, and Florida were intensively monitored for vegetation and wildlife during the DMRP. Other islands periodically surveyed for waterbird colonies by state agencies, local birding groups, and in a FWS nationwide survey in the early 1980s. National Park Service and Rutgers University has monitored islands in Long Island Sound and vicinities.

Success or Failure: Most of the islands were found to have some type of wildlife/waterbird nesting use. Most were relatively stable, although some were suffering erosion along channel sides. As a whole, most islands viewed as very successful, with locals and some agency people not even realizing they are manmade islands.

Costs: less than $1 per CY; most islands are so old that records have been lost

POC(s): Dr. Jim Parnell, University of North Carolina - Wilmington; Dr. Robert Soots, USACE-BERH, Fort Belvoir, VA; Roy R. Lewis, Lewis Environmental Services, Tampa, FL; Dr. Mike Erwin, FWS, Patuxent, MD; Dr. Johanna Burger, Rutgers University; Dr. Mary Landin, WES

Project Name: CORE SOUND ISLANDS

Corps Division: SAD

Project Type: seabird nesting islands constructed of maintenance dredged material

Project Size: over 15 acres

Project Location: Core Sound, near AIWW, North Carolina

Substrate Type: sand dredged material

Energy Sources: both wind fetch and wave energies affect all sides of islands

Protection Provided: 10 x 4 ft nylon sandbags built to form kidney-shaped configuration (to offer protected cove for feeding seabirds and wading birds)

Vegetation Used: smooth cordgrass and saltmeadow cordgrass planted along outer edges of shoreline, where sand was allowed to overtop the sandbags after islands were filled. Crest of islands purposely kept bare for best nesting substrate.

Project Constructed: 1978-1979

Monitoring: University of North Carolina at Wilmington, North Carolina State University, and Wilmington District monitored wildlife, vegetation, site stability, and other parameters. Local fishermen (or vandals) cut the sandbags on one island right after filling, and the island washed away. The other island is stable and thriving.

Success or Failure: One island failed due to vandalism. One island very successful.

Costs: (Bill Adams has this information)

POC(s): Dr. Jim Parnell, UNC-Wilmington; Dr. Steve Broome, NCSU; Bill Adams, Wilmington District; Barry Holliday, HQUSACE; Dr. Mary Landin, WES

Project Name: 76 PACIFIC COAST DREDGED MATERIAL ISLANDS AND SITES WITH WATERBIRD COLONIES

Corps Division: SPD, NPD

Project Type: wildlife islands using dredged material

Project Size: varies from 2.0 acres to over 200 acres

Project Location: from San Diego Harbor, California, to Everett Harbor, Washington, along major navigation channels (especially the Columbia and Snake Rivers system and the Sacramento/San Joaquin Rivers system)

Substrate Type: sand and aggregate (and volcanic material)

Energy Sources: very long wind fetches and strong wave energies against almost all islands, river currents, up to 10 ft tides

Protection Provided: none

Vegetation Used: natural colonization in all cases except Miller Sands Island

Project Constructed: most constructed either in the 1930s or in the 1950s when channels/harbors were deepened and widened

Monitoring: Islands in Oregon and Washington identified, researched, and evaluated during DMRP; those with waterbird colonies intensively monitored for vegetation utilization and bird populations. Other monitoring of islands incidental and local.

Success or Failure: some very successful, others never receive wildlife use or have too much human recreational pressures

Costs: less than $1 per CY; most islands are so old that records have been lost

POC(s): Jake Redlinger, North Pacific Division; Dr. Sid England, Sacramento District; Scott Miner, San Francisco District; Geoff Dorsey, Portland District; Ken Brunner, Seattle District; Dr. Mike Passmore, Walla Walla District; Dr. David Manuwal, University of Washington; others

Project Name: GREAT LAKES WATERBIRD NESTING ISLANDS AND SITES

Corps Division: NCD

Project Type: wildlife habitat development using dredged material

Project Size: varies from 1.0 acres to over 100 acres

Project Location: Islands located primarily where shipping channels were cut through connecting rivers and in harbors: Detroit River, Sault Saint Marie, Lake St. Clair, and Duluth are some of the locations.

Substrate Type: primarily sand and cobble

Energy Sources: river and lake currents, ship and barge wakes, sometimes strong wind fetches that are causing entire islands to disappear

Protection Provided: in some cases, none; in others such as in the Detroit River, islands are riprapped

Vegetation Used: natural colonization

Project Constructed: most were built in the 1950s

Monitoring: All of the islands have been monitored at least twice, in 1976-1977 during the DMRP and again in 1985, for waterbird colony locations and sizes. Vegetation that provides nesting substrate has also been documented. Beyond those data, monitoring has not occurred.

Success or Failure: mixed: a number of these islands are eroding severely, especially in the St. Mary's River area, and their value as nesting islands is all but lost. Where islands are stable, continued use by large tern and gull populations occurs. Islands offer havens for endangered species in the US Great Lakes.

Costs: estimated $1.00 per CY; most islands are so old that records have been lost

POC(s): Dr. Mary Landin, WES; Dr. Bill Scharf, Northwestern Michigan University; Dr. Jim Ludwig, private consultant; others

Project Name: 645 GULF COAST DREDGED MATERIAL WATERBIRD NESTING ISLANDS

Corps Division: SWD, LMVD, SAD

Project Type: wildlife islands using dredged material

Project Size: sizes of islands range from 0.5 acres to over 100 acres

Project Location: islands located throughout the Gulf Intracoastal Waterway system and in major harbors such as Mobile, Tampa, and Galveston

Substrate Type: most are built of sandy dredged material; some have silty sand or silt bases, especially in parts of Texas

Energy Sources: depends upon location within the waterway; most have some wave and wind actions; all are affected by barge and boat wakes

Protection Provided: for older islands, none; for CDF's, riprap or well-engineered dikes

Vegetation Used: all older islands colonized naturally; some additions or newer islands were partially planted

Project Constructed: most islands built in the 1930-1950s

Monitoring: Most islands have not had any monitoring, although over 50 percent in any given year will have 1 or more waterbird colonies on them. In Texas, the Fish-eating Bird Survey collected annual data on all colonies, but does not distinguish dredged material or natural islands. Periodic data have been collected in Louisiana, Alabama, Mississippi, and Florida. Extensive DMRP data exists on these bird islands, including vegetation in and out of colonies, feeding information, and nesting populations and relationships.

Success or Failure: Although most were not built purposely as nesting islands, their utilization as such has been highly successful.

Costs: less than $1 per CY; most islands are so old that records have been lost

POC(s): Dr. Mary Landin, WES; Dr. Rich Paul, National Audubon Society, Tavanier, FL; Dr. Bob Stewart, FWS, Slidell, LA; Dr. Brian Chapman, Corpus Christi State University; Dr. Allen Chaney, TAMI; Roy R. Lewis, Lewis Environmental Services Inc., Tampa, FL; others

Project Name: MILLER SANDS ISLAND MARSH CREATION SITE

Corps Division: NPD

Project Type: intertidal marsh creation, upland restoration, and dune stabilization using maintenance dredged material

Project Size: 150 acres (upland island), 3-mile-long sand spit, and 23 acre planted marsh

Project Location: Lewis and Clark National Wildlife Refuge, lower Columbia River, near Astoria, Oregon

Substrate Type: sand and volcanic dredged material

Energy Sources: 8-ft tides, very strong northwest 6-10-mile wind fetch, strong river and flood currents, and high wave energies

Protection Provided: no structures; marsh was protected behind the sand spit, which was stabilized with dune plantings

Vegetation Used: In intertidal marsh, 8 species tested. Dominant plantings were tufted hairgrass, slough sedge, and Lyngbye's sedge. On sand spit, American beachgrass was used. On upland (old sand dredged material island) seed mixture of grasses and legumes were used on prepared, limed, and fertilized, disked site.

Project Constructed: 1975-1976

Monitoring: Pre-, during, and post-construction monitoring conducted by WES, with assistance from Portland District, and their contractors (NMFS, Univ. of Washington, Oregon State University, others).

Success or Failure: All three habitats very successful. Upland only remains successful because FWS refuge personnel continue to apply fertilizer every few years to maintain growth of grasses. Legumes did not survive on long-term, and intense grazing by nutria and muskrats keep island vegetation under stress. Dune grass has spread from original plantings over 2 miles, and is holding sand spit; used by nesting seabirds. Marsh remains stable through management using dredged material by Portland District; they apply new dredged material to eroded spots along the channel side of the sand spit with every maintenance cycle. Three nearby marsh reference sites compared to planted marsh; no comparisons made of upland and dunes. Fisheries and benthos comparable on all sites; wildlife use spectacularly greater on Miller Sands.

Costs: $1.37 per CY

POC(s): Geoff Dorsey, Steve Stevens, Steve Martin, Portland District; Jake Redlinger, North Pacific Division; Dr. Mary Landin, WES; Dr. Mike Schiewe, NMFS.

Project Name: HART-MILLER ISLAND CDF

Corps Division: NAD

Project Type: confined disposal facility scheduled to be a recreational site when completed

Project Size: 1100 acres

Project Location: at Hart and Miller Islands, in Chesapeake Bay, near the Baltimore Channel, Maryland

Substrate Type: silty sand maintenance dredged material

Energy Sources: long wind fetch across Chesapeake Bay, strong wave energies

Protection Provided: riprap dike

Vegetation Used: natural colonization

Project Constructed: 1980's

Monitoring: Intensive pre-, during, and post-project monitoring has been conducted by the State of Maryland on water quality, soils, and other parameters. Site has progressed from connection of the two islands, to two cells being filled, to fresh marsh vegetation colonizing the cells. Considerable wildlife use occurring, including nesting by gulls. A long-term management plan has been agreed upon by all agencies, and is part of a state law. Use cannot change from recreation to habitat.

Success or Failure: Mixed reactions; site filled much quicker than anticipated because material was placed from other projects. Recreational development is slower than locals would like, but site is not completely full. Recreational beach has been built using dredged material.

Costs: (Frank Hamons or Jeff McKee have this information)

POC(s): Jeff McKee, Glenn Earhart, and Bob Blama, Baltimore District; Frank Hamons, Maryland Port Administration; Tom Patin and Dr. Mary Landin, WES

Project Name: LINCOLN AVENUE SALT MARSH/SEAGRASSES CREATION SITE

Corps Division: NPD

Project Type: salt marsh creation for mitigation

Project Size: less than 5 acres

Project Location: in Seattle, WA

Substrate Type: primarily sand dredged material

Energy Sources: low to moderate wind and wave energies

Protection Provided: none

Vegetation Used: eelgrass, sedges

Project Constructed: 1987-1988

Monitoring: Active mitigation monitoring program being conducted by University of Washington. Coordinated with Seattle District, EPA, state agencies, NMFS, FWS.

Success or Failure: short-term: very successful, long-term: being monitored

Costs: (Ron Thom has this information)

POC(s): Ken Brunner, Seattle District; Dr. Fred Weinmann, EPA; Dr. Mike Schiewe, NMFS; Dr. Ron Thom, University of Washington, Dr. Doug Clarke, WES

Project Name: MUZZI MARSH SALT MARSH RESTORATION SITE

Corps Division: SPD

Project Type: salt marsh restoration using dredged material

Project Size: over 50 acres

Project Location: north of Tiburon, in Marin County, on the western side of San Francisco Bay, California

Substrate Type: mixture silt and sand dredged material

Energy Sources: easterly wind fetch, sometimes has strong wave energies against shoreline

Protection Provided: existing dike from dredged material confinement was breached to provide intertidal flow

Vegetation Used: natural colonization with Pacific cordgrass and pickleweed

Project Constructed: 1980's

Monitoring: Most monitoring has been by California Coastal Commission; San Francisco District has kept track of this site because it is a mitigation site. The site was an old disposal site that was opened up to intertidal flow. At a later date a tidal channel was dug around the site to introduce water throughout the site. Parts were left as upland and the rest became wetland. Has nature trails, passive recreation opportunities throughout the site--excellent bird watching spot.

Success or Failure: successful

Costs: approximately $2.00 per CY (does not include mitigation costs per permit applicant)

POC(s): Phyllis Faber, California Coastal Commission; Scott Miner, San Francisco District; Dr. Mary Landin, WES

Project Name: WARM SPRINGS INTERTIDAL MARSH RESTORATION

Corps Division: SPD

Project Type: marsh restoration coupling dredged material and structures to provide water stability and intertidal elevations

Project Size: over 100 acres

Project Location: adjacent to South San Francisco Bay just north of San Jose, California

Substrate Type: silt dredged material

Energy Sources: long fierce northerly wind fetch and strong wave energies

Protection Provided: dikes and culverts

Vegetation Used: natural colonization

Project Constructed: in 1980's

Monitoring: Pre-construction baseline data collected by State and private consultant who built the project (Phil Williams and Associates). Long-term monitoring data limited, but being collected by state agencies to some extent. Project consists of several wetland areas connected to the Bay by tidal culverts, but protected from wave energy by dikes. Nature trails, bird watching, etc. part of project design; site receives considerable recreational use.

Success or Failure: successful

Costs: (Phil Williams has this information)

POC(s): Phil Williams, private consultant, San Francisco, CA; Scott Miner and Tom Wakeman, San Francisco District

Project Name: MOBILE THIN LAYER DREDGED MATERIAL PLACEMENT

Corps Division: SAD

Project Type: thin layer (not more than 12 inches) of dredged material placed over large bay bottom area as pilot demonstration

Project Size: less than 10 acres

Project Location: lower Mobile Bay, Alabama

Substrate Type: silt maintenance dredged material

Energy Sources: long wind fetch across Mobile Bay, and surface wave energies from boats and natural conditions

Protection Provided: none

Vegetation Used: none, not applicable

Project Constructed: 1988

Monitoring: Pre-, during, and post-project monitoring conducted by Mobile District, WES, and EPA. Dredged material was placed using a small dredge that could be manipulated to spread the material as it fell from the pipe in thin layers. Motile and non-motile organism impacts and recolonization and water quality were monitored. Minimal impacts resulted, and organism levels were at pre-project levels in 6 months.

Success or Failure: success

Costs: (Dr. Rees has these cost figures)

POC(s): Dr. Sue Rees and Doug Nester, Mobile District; Dr. Doug Clarke and Bob Lazor, WES; Bill Kruzynski, EPA

Project Name: TWITCH COVE SEAGRASS PLANTINGS

Corps Division: NAD

Project Type: seagrass bed restoration using maintenance dredged material

Project Size: less than 5 acres

Project Location: Twitch Cove, Chesapeake Bay, Maryland

Substrate Type: sand dredged material

Energy Sources: long wind fetch, and wave energies from all sides

Protection Provided: longard (geotextiles) tubes surrounding the site

Vegetation Used: eelgrass

Project Constructed: 1989

Monitoring: Pre-, during, and post-planting monitoring by Baltimore District, WES, and NMFS. Eelgrass bed planted behind protection of longard tubes

Success or Failure: grass bed appears to be failing

Costs: (Bob Blama has these costs)

POC(s): Robert N. Blama, Baltimore District; Mark Fonseca, NMFS; Dr. Doug Clarke, WES

Project Name: CRANEY ISLAND CDF

Corps Division: NAD

Project Type: confined disposal facility to hold Norfolk Harbor dredged material

Project Size: several hundred acres

Project Location: adjacent to the channel and attached to the mainland, in the city of Norfolk, VA

Substrate Type: silt dredged material

Energy Sources: river currents from the James River, 3-4 ft tidal range

Protection Provided: riprap dike

Vegetation Used: natural colonization

Project Constructed: 1980's

Monitoring: Pre-project engineering monitoring done by WES and Norfolk District. No pre-project environmental monitoring. Post-project monitoring has been almost exclusively engineering; however, wildlife use is occurring on the site, and natural marsh and upland vegetation is growing inside the CDF.

Success or Failure: Successful in that it holds dredged material from the Harbor. Unsuccessful in that it displaced river bottom and has no long-term environmental plan. Proposed plans for the CDF include development of a plan, development of the site as a local recreational park, development as an industrial site, additions of marsh -- some of these uses are not compatible, and choices will have to be made.

Costs: (Ronnie Vann has this information)

POC(s): Jim Melchor, Sam McGee, and Ronnie Vann, Norfolk District; Dr. Mike Palermo, WES

Project Name: POINTE MOUILLEE CDF WETLAND RESTORATION

Corps Division: NCD

Project Type: wetland restoration and shoreline stabilization combining structures and dredged material

Project Size: 4600 acres, 900 of which is a confined disposal facility built on and configured to an eroded barrier island

Project Location: in western Lake Erie on the Pointe Mouillee Waterfowl Management Area, near Flat Rock, Michigan

Substrate Type: silt and sand maintenance dredged material (both occur, depending upon where the dredge is working

Energy Sources: strong easterly wind fetch across Lake Erie

Protection Provided: riprap dike, reinforced inside and outside, and cross dikes for side protection

Vegetation Used: natural colonization

Project Constructed: 1976-1983 engineering; habitat development still occurring

Monitoring: Initial monitoring State of Michigan, Detroit District, EPA, WES. Long-term monitoring, WES. Site has a long-term management plan that includes visitors center, nature trails, hiking/biking/jogging, fishing piers, marina, and in-season waterfowl and small game hunting. Heavily used by locals, and by regional birding clubs. Wildlife use of site is spectacular; marsh is recovering from decades of erosion. Wetlands are intensively managed by Michigan DNR.

Success or Failure: highly successful

Costs: $9.43 per CY; construction costs of CDF with regard to total area protected/restored is $10,500 per acre

POC(s): Les Weigum, Detroit District; Dr. Mary Landin, WES; Bob Johnson and others, Michigan DNR

Project Name: TIMES BEACH CDF MARSH RESTORATION SITE

Corps Division: NCD

Project Type: wetland creation using dredged material

Project Size: over 25 acres

Project Location: in Lake Ontario, near Buffalo, NY

Substrate Type: silty sand dredged material

Energy Sources: wind fetch and some wave energies broken by the confined disposal facility dike

Protection Provided: CDF dike

Vegetation Used: natural colonization

Project Constructed: Project was originally constructed to hold dredged material from the nearby channel, but after one maintenance dredging cycle, Buffalo District built a new CDF due to the high level of wildlife use on the site and a request from the Audubon Society to have the site made into a bird sanctuary.
Monitoring: Pre-project monitoring was minimal; post-project monitoring conducted by the local Audubon Society chapter, and by WES.

Success or Failure: successful

Costs: (Don Borkowski has this information)

POC(s): Don Borkowski, Buffalo District; Dr. John Simmers and Dr. Mary Landin, WES

Project Name: JETTY ISLAND SALT MARSH/SEAGRASSES CREATION SITE

Corps Division: NPD

Project Type: island, marsh, and seagrass habitat development using dredged material

Project Size: over 50 acres

Project Location: adjacent to the Shohomish River mouth and harbor channel in Puget Sound, at Everett, Washington

Substrate Type: sand dredged material

Energy Sources: several mile westerly wind fetch, 8+-ft tides, river currents, current movement within Puget Sound

Protection Provided: none on main energy side; bulkhead on channel side receiving river currents

Vegetation Used: Original island had natural colonization; new marsh, mudflat, and upland planted with tufted hairgrass, slough sedge, dune grasses, eelgrass, and other species.

Project Constructed: Original dredged material island over 100 years old. Has been added to in maintenance dredging many times. New marsh built 1989.

Monitoring: Intensive study during DMRP (1970's). Low-level observations and data collection until 1985, then intensive again prior to island addition and marsh planting. Detailed monitoring plan agreed upon by interagency working group, and being carried out by Seattle District, Port of Everett, and State of Washington.

Success or Failure: Highly successful site. Island upland used for day visits, with park rangers, nature tours. First Arctic tern nests in contiguous states on Jetty Island; much wildlife use. New marsh and seagrass bed sites are thriving; natural colonization has occurred with additional species. Long-term monitoring program will continue.

Costs: (Hiram Arden has this information)

POC(s): Hiram Arden and Ken Brunner, Seattle District; Justine Smith and Dr. Fred Weinmann, EPA; Dr. Mike Schiewe, NMFS; Dr. Mary Landin, WES; Dr. Ron Thom, University of Washington.

Project Name: HARKERS ISLAND MARSH CREATION SITES

Corps Division: SAD

Project Type: salt marsh and seagrass creation on older dredged material deposits shaved down to intertidal and sub-tidal elevations as test plots for NMFS/USACE MOA studies.

Project Size: three sites of less than 5 acres each

Project Location: along the AIWW, near Beaufort, NC

Substrate Type: sand dredged material

Energy Sources: several mile wind fetch, limited wave energy problems

Protection Provided: steep banks on each side of the shaved down areas left in place for side slope protection

Project Constructed: 1987

Monitoring: Monitoring by NMFS with limited assistance by WES.

Vegetation Used: smooth cordgrass and eelgrass

Success or Failure: Initial data and site observations by WES indicate sites are tracking along exactly as new marshes and seagrass beds on sand substrate along the Atlantic Coast are expected to grow in spite of poor project design. NMFS disagrees that sites are working but has never released data.

Costs: (Frank Yelverton has this information)

POC(s): Paul Knutson, private consultant, Glouchester Point, VA (for WES); Dr. Doug Clarke and Jack Pullen, WES; Mark Fonseca, NMFS; Frank Yelverton, Wilmington District

Project Name: TEXAS CITY DIKE MARSH CREATION SITE

Corps Division: SWD

Project Type: marsh creation

Project Size: less than 5 acres

Project Location: on the northeast side of Texas City Dike in Galveston Bay, Texas City, Texas

Substrate Type: silty sand dredged material

Energy Sources: long wind fetch from north, both natural and boat-generated wave energies

Protection Provided: rubble breakwater put into place after the marsh was planted and established, but was beginning to fail

Vegetation Used: smooth cordgrass

Project Constructed: 1978-1979

Monitoring: initial monitoring, Galveston District; long-term observations, WES. Fish and shellfish, and clapper rail and other bird, use of the little marsh recorded. Public reaction favorable, with use of the marsh fringes as fishing spots.

Success or Failure: initial plantings successful; over time, combination of waves and wind began taking out the marsh. District placed a rubble breakwater along the northeast outer edge, and the marsh stabilized. This is a very small marsh pilot project. The concept could be expanded considerably along the Texas City Dike.

Costs: approximately $1.25 per CY (less than other placement options)

POC(s): Rob Hauch, Dolan Dunn, or Rick Medina, Galveston District; Dr. Mary Landin, WES; Dr. Jim Webb, TAMU

Project Name: BUTTERMILK SOUND MARSH RESTORATION SITE

Corps Division: SAD

Project Type: salt marsh restoration on old maintenance dredged material sand which smothered existing salt marsh; project shaved down mound to intertidal elevation and planted as experiment

Project Size: entire island positively influenced by project was over 20 acres; initial project was 7 acres

Project Location: Atlantic Intracoastal Waterway, Buttermilk Sound, mouth of Altamaha River, Georgia, north of Brunswick

Substrate Type: sand maintenance dredged material

Energy Sources: minimal

Protection Provided: none

Vegetation Used: 8 high and low marsh species, including smooth cordgrass, saltmeadow cordgrass, big cordgrass, marsh elder, sea oxeye, saltgrass, other minor species in test plots. Over time, site was dominated by smooth, big, and saltmeadow cordgrasses typical of surrounding marshes.

Project Constructed: island mound formed in 1960's; marsh creation project begun in 1974

Monitoring: long-term data collected by University of Georgia and WES (pre-, during, and post-construction intensive monitoring)

Success or Failure: Revegetation highly successful, wildlife and fisheries use more abundant than 3 nearby natural reference marshes to which it was compared. Remaining upland mound that was not shaved down received high seabird use, including nesting terns and skimmers. From a "marsh" perspective, project highly successful; from a "displacement of one of two potential seabird nesting areas for miles around" standpoint, project probably should not have happened.

Costs: $0.98 per CY; with approximately $2500 per acre for planting experimental area; site preparation costs were $2000

POC(s): Dr. Bob Reimold, Metcalf and Eddy (formerly of University of Georgia); Dr. H. K. Smith, Jacksonville District; Dr. Mary Landin, WES, Paul Knutson, private consultant, Glouchester Point, Virginia (no one left in Savannah District who worked on project)

Project Name: ARANSAS NATIONAL WILDLIFE REFUGE SHORELINE STABILIZATION PROJECT

Corps Division: SWD

Project Type: stabilization of eroded marsh shoreline using maintenance dredged material, and engineering and bioengineering techniques coupled with marsh plantings

Project Size: several miles of refuge shoreline to be protected

Project Location: Aransas NWR, Texas, north of Corpus Christi, along the GIWW

Substrate Type: silty sand and silt dredged material, depending upon where within the GIWW the dredged material is obtained

Energy Sources: barge and boat wakes, some wind fetch and natural wave energies from San Antonio Bay

Protection Provided: combinations of geotextiles, concrete/stones, and bioengineering structures

Vegetation Used: smooth cordgrass planted in and around the protective material

Project Constructed: to be built in FY 93

Monitoring: pre-construction data being collected by WES and FWS; construction will be monitored by WES and Galveston District; post-construction data will be collected by WES, Galveston District, and FWS

Success or Failure: not applicable on large project; small pilot project put in place by volunteer labor using saltwater-tolerant concrete bags in 1989 are still in place, but overwash is causing continued impact on marshes along parts of shoreline

Costs: (Ron Hauch has this information)

POC(s): Rob Hauch and Dr. Neil McLellan, Galveston District; Jack Davis, Hollis Allen, Dr. Steve Maynord, or Dr. Mary Landin, WES

Project Name: HILLSBOROUGH BAY CDF MARSH CREATION SITES

Corps Division: SAD

Project Type: Two CDF islands built to hold new work and maintenance dredged material from Tampa and Hillsborough Bays, Florida, where marshes were created along shorelines and nesting habitat provided on island surfaces.

Project Size: Total of the two islands: several hundred acres.

Project Location: Hillsborough Bay, Florida, near Tampa

Substrate Type: sand dredged material

Energy Sources: wave energies and wind fetches from all sides of both islands

Protection Provided: marsh plantings and limited bioengineering (some riprap may now be in place that I am unaware of)

Vegetation Used: smooth cordgrass sprigs, with mangrove seed pods in the marsh stand

Project Constructed: 1978-1979

Monitoring: State of Florida and local consulting firm are monitoring.

Success or Failure: Islands are stable, habitats are successful. Islands are being filled with maintenance material.

Costs: $11.25 per CY, with 25-year design life of the two islands

POC(s): Roy R. Lewis, Lewis Environmental Services Inc., Tampa, FL; Dr. H. K. Smith, Jacksonville District; Dr. Mary Landin, WES

Project Name: FINA LA TERRE MARSH MANAGEMENT SITE

Corps Division: LMVD

Project Type: restoration and management of existing marsh being impacted by salt water intrusion, subsidence, and erosion using structures and some dredged material

Project Size: management unit is several hundred acres, dredging area is smaller

Project Location: Terrebonne Parish, LA

Substrate Type: silt and sand

Energy Sources: negligible except in storm events

Protection Provided: structures put in place to keep out salt water that killed existing marsh vegetation, and to allow water level manipulation

Vegetation Used: No plantings. Natural colonization and succession. Project is privately owned, and is being used as a mitigation bank.

Project Constructed: 1980's

Monitoring: Environmental monitoring is an interagency arrangement between La. DNR, LSU, EPA, New Orleans District, and Minerals Management Service. Engineering monitoring will be conducted beginning FY 92 by WES.

Success or Failure: questionable--some agencies like the project, others don't -- seems to mostly depends upon whether you subscribe to intensive marsh management activities vs. passive management of natural wetlands.

Costs: (Bill Good has this information)

POC(s): Sue Hawes, New Orleans District, Dr. Mary Landin or Joe Letter, WES, Dr. Bill Good, La. DNR

Project Name: SOUTHWEST PASS MARSH RESTORATION SITE(S)

Corps Division: LMVD

Project Type: restoration of subsided and eroded intertidal marsh on the western side of the Southwest Pass using unconfined dredged material placed at sub-tidal elevations

Project Size: several thousand acres of new marsh since 1974

Project Location: below Head of Passes, on the western side of Southwest Pass

Substrate Type: silty sand dredged material

Energy Sources: several miles of westerly wind fetch

Protection Provided: none

Vegetation Used: No plantings. Sites colonized in variety of plants within 3-5 years, including smooth cordgrass, big cordgrass, saltmeadow cordgrass, other common Louisiana coastal plants, including on a couple of high spots, common reed (which will be displaced by succession and subsidence).

Project Constructed: marsh restoration begun in 1974 and continued every year during maintenance dredging operations

Monitoring: monitoring using remote sensing and older aerial photos, backed up by ground truthing data collected along permanent transect lines in various age marshes.

Success or Failure: generally very successful; some spots were allowed to build too high, but these will become marsh over time as the land continues to subside. Dredged material placement technique refinement being evaluated at WES under the Wetlands Research Program.

Costs: in 1970s, an additional $.50 per CY; costs are increasing to an addition $1 to $2 per CY as placement areas are further and further away from channel

POC(s): Dr. Mary Landin or Joe Letter, WES, Sue Hawes and Dr. Linda Glenboski, New Orleans District, Dr. Jim Webb, TAMU

Project Name: MISSISSIPPI RIVER GULF OUTLET MARSH NOURISHMENT

Corps Division: LMVD

Project Type: use of maintenance dredged material to restore subsided marsh on one side of the channel

Project Size: approximately 100 acres (may be larger)

Project Location: adjacent to the MRGO, which connects the Mississippi Sound and the Mississippi River, Louisiana

Substrate Type: silt and sand

Energy Sources: barge wakes in the MRGO

Protection Provided: none

Vegetation Used: No planting. Natural colonization occurred within 3-5 years.

Project Constructed: in the 1980s

Monitoring: very limited, basically just observational data

Success or Failure: Quite successful; a controversy exists in the area because of the lack of dredged material to continue the process. It has become less expensive to take MRGO material to the Gulf rather than to build marsh, and limited dredging budgets made the New Orleans District recently choose this option.

Costs: (Dr. Glenboski has this information)

POC(s): Dr. Linda Glenboski, New Orleans District, Dr. Mary Landin or Joe Letter, WES, Dr. Bill Good, La DNR

Project Name: COFFEE ISLAND MARSH CREATION SITE

Corps Division: SAD

Project Type: marsh creation on old dredged material island

Project Size: less than 5 acres

Project Location: adjacent to the Gulf Intracoastal Waterway (GIWW) in Mississippi Sound, AL, near Bayou le Batre

Substrate Type: sandy dredged material

Energy Sources: wind and wave fetches within the Sound and from the GIWW

Protection Provided: bioengineering (plant rolls and erosion control matting)

Vegetation Used: smooth cordgrass was planted on bare sandy shoreline

Project Constructed: planting occurred in 1985

Monitoring: monitoring included only vegetation

Success or Failure: short-term mixed success; long-term data not being collected

Costs: $1.25 per CY

POC(s): Hollis Allen, WES, or Paul Bradley, Mobile District

Project Name: ATCHAFALAYA RIVER DELTA MARSH NOURISHMENT SITES

Corps Division: LMVD

Project Type: marsh and bird island nourishment using maintenance dredged material from the GIWW

Project Size: several sites of several acres each

Project Location: mouth of the Atchafalaya River, Louisiana

Substrate Type: silty dredged material

Energy Sources: river currents, some barge wakes within the GIWW, some wave energy from the Gulf

Protection Provided: none

Vegetation Used: allowed to colonize naturally (in case of bird islands, vegetation is not encouraged)

Project Constructed: at different times in the 1970s and 1980s

Monitoring: very limited, general observations by New Orleans District and Louisiana DNR personnel

Success or Failure: short-term: successful for marsh, high successful for birds, long-term: islands and marsh will required continued nourishment to remain in place

Costs: (Sue Hawes has this information)

POC(s): Scott Clark, New Orleans District, Dr. Bill Good, Louisiana DNR, Dr. Mary Landin or Joe Letter, WES

Project Name: GAILLARD ISLAND CDF

Corps Division: SAD

Project Type: a confined disposal facility built of dredged material in Mobile Bay; marsh was planted along the northwest dike

Project Size: the CDF is a triangular-shaped island 1300 acres in size; the planted marsh, a demonstration project, is 35 acres

Project Location: two miles out in the Bay from Theodore, Alabama

Substrate Type: silty sand dredged material

Energy Sources: wave and wind energies buffet all three sides of the island, with long wind fetches and with ship/barge wakes hitting the south and east dikes

Protection Provided: the east and part of the south dikes were riprapped; planting occurred behind floating tire breakwaters on the northwest dike, and using plant rolls and erosion control matting

Vegetation Used: smooth cordgrass was planted. Natural colonization behind berms which formed from trapped sediments included saltmeadow cordgrass, saltmarsh bulrush, saltmarsh cattail, American three-square, and a number of other minor species in the marsh zones. The upland was aerially seeded with grasses, then planted with a variety of both exotic and native tree species (District's choice--only the native species survived).

Project Constructed: island built in 1980-81; marsh tests begun in 1981-82; monitoring begun in 1981.

Monitoring: Island was created over bay bottom, but no baseline data were collected on fishes or benthos; seagrasses not present. Island monitoring included vegetation, wildlife, some fisheries, physical changes. Seabird use of the island has been spectacular, with thousands of pairs of over 20 species of terns, gulls, skimmers, pelicans, stilts, and others nesting on the island in increasing numbers since its construction. Wading bird began occurring in 1988, when vegetation reached successional stages that would support their nests.

Success or Failure: short-term: success of planted marsh mixed, success of colonized marsh very high, success of wildlife use of island habitats, excellent.

Costs: approximately $1.25 per CY; CDF was constructed to have life of expectancy of approximately 40 years (this is changing as other projects such as Navy Homeporting are tying into project)

POC(s): Dr. Sue Rees, Mobile District, or Dr. Mary Landin, WES
Tom Olds, FWS Atlanta, Dr. Jim Webb, TAMU

Project Name: APALACHICOLA BAY MARSH CREATION SITE

Corps Division: SAD

Project Type: salt marsh creation using new dredged material placed inside the dike of an older dredged material island

Project Size: less than 10 acres

Project Location: Apalachicola Bay, Florida

Substrate Type: silty dredged material placed within and over a sand dredged material island substrate

Energy Sources: long southerly wind fetch from the Gulf of Mexico

Protection Provided: the south dike of the island was used as a breakwater, with a breach provided for intertidal flow

Vegetation Used: planted with smooth cordgrass in low marsh zone and saltmeadow cordgrass in higher marsh zone. Island upland was planted in pines and grasses. Much natural colonization occurred in the marsh and in the upland.

Project Constructed: Island built prior to 1974. Dredged material placed inside island in 1975, site planted in 1976.

Monitoring: Site has been monitored since 1974-75,and had 3 natural reference marshes for comparisons.

Success or Failure: short-term: highly successful; long-term: some of the marsh is washing out near the dike breach, which has widened

Costs: approximately $1.25 per CY for maintenance material; island was constructed to have several dredging cycles' life expectancy

POC(s): Dr. Sue Rees, Mobile District, or Dr. Mary Landin, WES

Project Name: WEST BAY SHORELINE STABILIZATION PROJECT

Corps Division: SWD

Project Type: stabilization of eroding shoreline using maintenance dredged material, and engineering and bioengineering techniques coupled with marsh plantings

Project Size: currently approximately 20 acres in a test project, could expand considerably if necessary

Project Location: West Bay, GIWW, Texas

Substrate Type: silty sand and silt dredged material (depends upon where in the GIWW dredged material is obtained)

Energy Sources: barge wakes, some wind fetch and natural wave energies

Protection Provided: planned use of combinations of geotextiles, stone/concrete, erosion control mat, plant rolls -- final list not completed yet

Vegetation Used: smooth cordgrass will be planted behind and in protective material

Project Constructed: to be built in FY 92

Monitoring: pre-construction data collected by WES and TAMU; construction monitoring will be WES and Galveston District; post-construction data will be collected by WES, TAMU, and Galveston District

Success or Failure: not applicable

Costs: (Rob Hauch has this information)

POC(s): Rob Hauch and Dr. Neil McLellan, Galveston District, Jack Davis, Dr. Steve Maynord, and Hollis Allen, WES; Dr. Jim Webb, TAMU

Project Name: ST. JOHNS RIVER MARSH CREATION/MANAGEMENT SITE

Corps Division: SAD

Project Type: intertidal marsh creation, marsh management using dredged material

Project Size: several hundred acres

Project Location: along the St. Johns River, near Jacksonville, Florida

Substrate Type: silt and silty sand dredged maintenance dredged material

Energy Sources: river traffic wakes, river currents, minimal wind fetch, minimal tidal impacts

Protection Provided: not sure (contact Lemlich)

Vegetation Used: none; natural colonization

Project Constructed: early 1980's

Monitoring: extremely limited data collected by local and state agencies

Success or Failure: from all observations, very successful and site is stable, but project success criteria not established and monitoring not carried out.

Costs: (Sandy Lemlich has this information)

POC(s): Sandy Lemlich, WES; Dr. H. K. Smith, Jacksonville District

Project Name: WINYAH BAY MARSH CREATION SITE

Corps Division: SAD

Project Type: marsh creation using maintenance dredged material placed adjacent to 60-year-old dredged material island

Project Size: in 1991, more than 100 acres

Project Location: off Middle Ground Island in Winyah Bay, near Georgetown, SC

Substrate Type: silt dredged material

Energy Sources: river currents, several mile wind fetch, close to a very strong tidal area (the Gorge) that provides the inlet to Winyah Bay

Protection Provided: none

Vegetation Used: none, natural colonization by smooth cordgrass and saltmarsh bulrush

Project Constructed: dredged material placement for marsh begun in 1974. A number of older naturally-vegetated dredged material islands from channel construction already in Bay that are primarily used for recreation by boaters.

Monitoring: Limited monitoring begun by WES in 1989. Using remote sensing, different ages of marsh determined and studied. Each deposit of dredged material appeared to colonize with smooth cordgrass within 3 years of being deposited; some areas remain large very productive mudflats. Different age "new marsh" compared to a much older natural marsh across the channel (no new marshes in SC available for comparison). Marsh and mudflat macrobenthos, fisheries, vegetation, wildlife, insects, and soils data collected and analyzed.

Success or Failure: based on monitoring that began 15 years after project begun, marsh formation is successful once sediment stabilization occurs. New marsh is forming on a annual basis, mudflats are relatively stable. Problem is much of the newly-placed dredged material is washed out of the Bay through a deep gorge that connects it with the Atlantic before stabilization can occur.

Costs: $1.25 per CY

POC(s): Jim Woody and Braxton Kyzar, Charleston District; Dr. Doug Clarke and Dr. Mary Landin, WES; Dr. Mark LaSalle, Marine Extension Service, USDA

Project Name: MOTT ISLAND AND OTHER ISLANDS

Corps Division: NPD

Project Type: habitat development using dredged material

Project Size: several islands of varying sizes

Project Location: Mott, Sand, Rice, and other dredged material islands are located in and around Lewis and Clark and Columbia White-tailed Deer National Wildlife Refuges in the lower Columbia River, Oregon.

Substrate Type: primarily sand

Energy Sources: strong wind and wave energies, 8-ft tides

Protection Provided: none

Vegetation Used: natural colonization

Project Constructed: in the 1950s, and some are added to on a regular basis using maintenance dredged material

Monitoring: Primarily limited to the 1970's. Extensive studies done on Mott, Sand, and Rice Islands during the USACE Dredged Material Research Program to document vegetation and soil successional changes on manmade islands and their use as habitats. Continued eagle and other wildlife observations made on islands on a regular basis.

Success or Failure: Stable and successful, although the islands with maintenance dredged material need to be expanded or new islands built due to (1) heights of presently mounded dredged material and (2) the loss of habitat due to having to put material in such confined locations over and over again. Much songbird, small mammal, and goose use of islands.

Costs: islands are so old that this information is probably no longer available

POC(s): Dr. Mary Landin and Jean O'Neil, WES; Geoff Dorsey and Steve Stevens, Portland District; Jake Redlinger, North Pacific Division

Project Name: WINDMILL POINT MARSH CREATION SITE

Corps Division: NAD

Project Type: fresh intertidal marsh creation using maintenance dredged material

Project Size: 15 acres

Project Location: at Windmill Point in the James River, east of Hopewell, VA

Substrate Type: both sand dredged from a borrow area and silt maintenance dredged material were used

Energy Sources: strong river and flood currents, 3-ft tides, several mile wind fetch from west

Protection Provided: temporary sand dike served as breakwater

Vegetation Used: on dike, grasses and forbs; in island interior, natural colonization occurred before site could be planted.

Project Constructed: In 1974; first marsh purposely designed and built by the USACE. Site agreed upon by interagency state and federal working group.

Monitoring: Pre-, during, and post-construction monitoring by WES and its contractors (UVa, VIMS, Old Dominion University, Environmental Concern Inc., others).

Success or Failure: Island broke in half when sand dike failed, and interior marsh mostly washed out in 1983. As a stable marsh, a failure. As a protected shallow water habitat for fish spawning and use by wildlife on remnant island, successful. Many lessons learned in early effort.

Costs: approximately $1.00 per CY for construction

POC(s): Craig Selzer, Tom Yancy, Sam McGee, and Ronnie Vann, Norfolk District; Dr. Bob Diaz and Dr. Gene Silberhorn, VIMS; Dr. Ed Garbisch, Environmental Concern Inc., Dr. Mary Landin, WES, Charles Newling, Wetland Science Associates (formerly of WES)

Project Name: BODKIN ISLAND MARSH RESTORATION SITE

Corps Division: NAD

Project Type: island and marsh restoration using maintenance dredged material

Project Size: 7 acres

Project Location: approximately 2 miles off mainland, near Kent Narrows and Chester River, in Queen Annes County, Maryland

Substrate Type: sand dredged material

Energy Sources: long wind fetch and moderate to high wave energies from the southeast/southwest; 2-mile wind fetch and lower wave energies from the northeast/northwest.

Protection Provided: riprap

Vegetation Used: Island to be planted with smooth cordgrass, saltmeadow cordgrass, saltmarsh bulrush, Olney's threesquare, and marsh elder in marsh zone; Japanese honeysuckle, poison ivy, saltmeadow cordgrass, and black cherry on black duck nesting area (upland); and widgeongrass, horned pondweed, and sago pondweed in protected tidal pools. (island designed by WES with input from other agencies)

Project Constructed: will begin in October 1991

Monitoring: Baseline data collection by WES, Baltimore District, Maryland DNR, and FWS (Annapolis office). Island construction monitoring by WES and Baltimore District. Post-construction monitoring by WES, District, Maryland DNR, FWS, and Vern Stotts (retired FWS).

Success or Failure: high level of success predicted by interagency working group

Costs: estimated cost is $1,000,000 for entire island construction (7 acres)

POC(s): Bob Blama, Baltimore District; John Gill and John Wolflin, FWS; Bill Carter and Jonathan McKnight, Maryland DNR; Dr. Steve Maynord, Jack Davis, Dr. Mary Landin, Dr. Don Hayes, WES.

Project Name: BARREN ISLAND MARSH CREATION/NESTING ISLAND

Corps Division: NAD

Project Type: marsh and seabird nesting island creation using maintenance dredged material

Project Size: approximately 20 acres (may be larger)

Project Location: Chesapeake Bay, Maryland

Substrate Type: sand dredged material

Energy Sources: low to moderate wind fetch and wave energies

Protection Provided: marsh planting used to protect nesting areas

Vegetation Used: smooth cordgrass planted on island fringes. Oyster shell material placed on island crest for nesting terns.

Project Constructed: 1984-1985

Monitoring: limited data collected by Baltimore District and Environmental Concern Inc., general observations by FWS

Success or Failure: short-term indications from nesting use and marsh stability are success; long-term information not yet in. Site has been added to more than one time by maintenance dredged material at much cost savings to the District, and has potential for being used again.

Costs: cost savings of $63,000 during last dredging cycle Barren Island was used, even with additional planting and nesting substrate costs

POC(s): Glenn Earhart and Bob Blama, Baltimore District; Dr. Ed Garbisch, Environmental Concern Inc., St. Michaels, MD; John Gill, FWS

Project Name: DONLIN ISLAND/VENICE CUT, SACRAMENTO DELTA, CA

Corps Division: SPD

Project Type: intertidal fresh and brackish marsh restoration on subsided land using maintenance dredged material

Project Size: 35 acres (both islands)

Project Location: San Joaquin River, near Stockton, CA

Substrate Type: silt and sand dredged material

Energy Sources: river currents primarily, minimal barge and boat wakes, weak intertidal influence (Donlin Island is brackish intertidal, Venice Cut is fresh intertidal)

Protection Provided: none

Vegetation Used: natural colonization

Project Constructed: 1983

Monitoring: Long-term monitoring program set up by Sacramento District and University of California-Davis, with assistance from WES. Monitoring was a doctoral dissertation project, and included vegetation, wildlife, fisheries, other parameters.

Success or Failure: Both projects successful and relatively stable; both have room for additional dredged material to expand the marshes, although demand for dredged material for levee repair is strong and continuous, and probably will preclude any additions to the sites.

Costs: approximately $1.50 per CY with 1,000,000 CY placed at the two sites (much less cost than other placement options)

POC(s): Dr. Sid England, Sacramento District; Dr. Mary Landin, WES; Fred Nikaji, FWS (retired, but living in area)

Project Name: SALT POND #3 MARSH RESTORATION SITE

Corps Division: SPD

Project Type: salt marsh restoration and salt pond rehabilitation using dredged material

Project Size: 111 acres

Project Location: south of Hayward, CA, in South San Francisco Bay, at the mouth of the Alameda Flood Control Channel

Substrate Type: silt dredged material

Energy Sources: long fierce northwesterly wind fetch across the Bay, and 4-5 ft tides

Protection Provided: existing dike at site was breached to provide intertidal flow to the marsh

Vegetation Used: Pacific cordgrass, 2 species of pickleweed

Project Constructed: salt pond had been in existence for decades; marsh project carried out 1973-1976

Monitoring: Site was considered a demonstration under the DMRP, and was not subject to the intensity level of monitoring other DMRP sites were. Initial monitoring under local contract included only vegetation and birds. Long-term monitoring by WES included soils, vegetation, wildlife, physical changes (no fisheries or benthos), and is still on-going. Although less than 10 acres of the site was planted, the entire site colonized in pickleweed. Succession has been rapid, and the site now resembles older typical salt marshes of the Bay -- it no longer supports Pacific cordgrass, but is almost entirely pickleweed. The nearby channel has silted in, and has colonized with cordgrass.

Success or Failure: Successful, although some people think the site is too high to be a good marsh because intertidal flow does not reach the upper 1/3 of the site.

Costs: $1.68 per CY (1973 cost including material transport, site preparation, and planting)

POC(s): Dr. Mary Landin, WES; Scott Miner and Tom Wakeman, San Francisco District

BENEFICIAL USES OF DREDGED MATERIAL EXAMPLES

Project Name: BOLIVAR PENINSULA MARSH CREATION SITE

Corps Division: SWD

Project Type: salt marsh creation using a previously-placed dredged material deposit

Project Size: old Bolivar, 10 acres; new Bolivar, 10 acres; control Bolivar, 10 acres; 3 natural reference sites, varying sizes

Project Location: Goat Island, Galveston Bay, Texas

Substrate Type: fine grained sand dredged material

Energy Sources: 26 mile northerly wind fetch across Galveston Bay

Protection Provided: temporary 10 x 4-ft sandbags filled with dredged material to form a dike at old Bolivar site in 1975; floating tire breakwater, plant rolls, and erosion control mat at new Bolivar site in 1980's

Vegetation Used: Smooth cordgrass in the low marsh zone and saltmeadow cordgrass in the high marsh zone were planted behind temporary breakwaters, although several minor upland plant species were tested in the upper zone at the old Bolivar site in the 1970's. Much natural colonization occurred, especially in the high marsh and upland areas.

Project Constructed: first dredged material placed in 1960s, marsh project initiated in 1975 on old Bolivar, marsh project initiated in 1980 on new Bolivar

Monitoring: Monitoring has occurred since 1974 on old Bolivar. Old Bolivar was compared to 3 natural reference marshes. New Bolivar and control Bolivar (where no planting occurred) monitoring initiated in 1980 (6 marsh sites in all).

Success or Failure: short-term success of marsh: good; long-term success: looking okay but still being monitored

Costs: less than $1 per CY, approximately $2500 per acre to plant, geotextile dike was additional expense

POC(s): Dr. Mary Landin or Hollis Allen, WES; Dr. Jim Webb, TAMU; Rob Hauch, Dolan Dunn, and Rick Medina, Galveston District

Summary

As the nation maintains its navigable waterways and provides flood protection to its citizens, the resulting dredged material becomes an abundant resource that should not be wasted. Only about 40 percent of such material is used beneficially, and there is much room for improvement. Limiting factors for increased use are costs, the currently defined federal standard for dredging, and need for more proof through research that certain kinds of beneficial uses are in fact successful and predictable.

Wetland restoration and creation has been a highly successful use of dredged material, although it has limitations of costs, transport, achieving precise elevations, and the possible displacement of other habitats. Wildlife islands, which include wetland fringes, and beach nourishment, including sea turtle nesting beaches, are also highly successful uses of dredged material. There are numerous other natural resource benefits to be gained from incorporating suitable dredged material into habitat restoration/creation designs.

Increased efforts among federal and state agencies responsible for dredging and dredged material placement decisions should be made to find ways and funding to use more dredged material for habitat restoration and creation and other natural resource benefits.

multiple purpose uses. An example is Hart-Miller Island, an 1100-acre facility in Chesapeake Bay that is slated to become an upland park for use by boating Maryland citizens upon completion. Hart-Miller will include bathing beaches, ponds, paths and walks, and other recreational facilities, while still providing habitat for waterbird and other species.

A multiple purpose project that is currently being planned involves use of many millions of cubic yards of dredged material from the Houston, TX, Ship Channel deepening and widening work. An interagency beneficial uses committee has agreed upon a plan of action that will include a human-use destiny island for recreational boaters, a nesting island for waterbirds and other wildlife, fishing reefs, oyster beds, and wetland restoration---all constructed from the dredged material from the project. While the final plan has not yet been approved, the state and federal natural resource, regulatory, and construction agencies responsible for Galveston Bay are quite pleased with the concept of the beneficial uses proposed.

Another example of an urban multiple purpose project is the 35-acre wetland restoration using dredged material of Kenilworth Marsh in the heart of Washington, DC, adjacent to the Anacostia River. This site, owned by the National Park Service, is utilizing dredged material from a Baltimore District project to raise the elevation of the degraded lake to an intertidal elevation. The new wetland will be planted in the spring of 1993, and includes canoe channels, observation points, and other human recreational uses, as well as providing a considerable extension of the available natural resource habitats in the District of Columbia. It is funded by the Corps and the National Park Service; non-funding partners include the U. S. Fish and Wildlife Service and the District of Columbia Council of Governments.

Case Studies

To further emphasize the possibilities of beneficial uses, three examples of beneficial uses of dredged material for wetland restoration/creation are presented in the slide presentation: Winyah Bay, South Carolina; Gaillard Island, Alabama; and Pointe Mouillee, Michigan. The first site uses the least costly and easiest construction techniques, the second site requires more innovation and engineering technology to construct, and the third site involves massive construction technology and very complex design, implementation, and management. It should be noted that there are other equally valid beneficial uses of dredged material besides wetlands, and these include wetlands as one component in a complex multiple purpose project.

Each of these projects have been discussed in great detail in U. S. Army Corps of Engineers technical reports, and the journals of Society of Wetland Scientists and the Western Dredging Association. Readers are referred to those documents for additional information concerning goals, design, construction, chronology, long-term monitoring, management strategies, and partnering and coordination.

Rivers, and seagrasses in several Atlantic and Pacific Coast locations.

Underwater berms and Nesting Beaches. Twenty-three underwater berms have been constructed using dredged material for storm attenuation and or beach nourishment and have been studied by engineers for stability and function. Only one of these, the stable berm off Dauphin Island, AL, has been studied in detail for biological parameters to determine fish use and recovery of motile and non-motile organisms. Data show that benthos on the berm has recovered rapidly, and fish use by numerous species of various age classes is greater than the surrounding waters. Results are correlated to slope, configuration, and placement orientation in the current.

Engineering data collected at the Dauphin Island feeder berm indicate the sediment is moving off the berm into the nearshore littoral drift system. The second site where any biological data have been collected as part of project assessment is at the Dam Neck stable berm site off Norfolk, VA, where data collected after project completion indicate that the berm is providing overwintering habitat for blue crabs from Chesapeake Bay.

Forestry, Horticulture, and Agriculture.

Numerous interior, upland dredged material placement sites that are no longer in use, or that have up to 10 years between maintenance dredging operations, have been used for forestry, horticulture, and agriculture. Most of these sites have sandy or sandy silt substrates rather than heavy clays. Examples of horticultural/truck crop use include cabbage, sweet corn, and other commercial garden crops growing on dredged material adjacent to the Columbia River, the IWW in New Jersey, and other locations. Pulpwood plantations, bottomland hardwoods, and riparian forests have been planted on infrequently used sites in the Tennessee-Tombigbee Waterway, the Ohio River Valley, the lower Mississippi River Valley, and the upper Mississippi River. One of the more common agricultural uses of dredged material sites along inland mid-western rivers is cattle grazing; in Vancouver, WA, a cattle feedlot is located in a placement site. In South Carolina and other southern states, soybeans, other row crops, and hay crops are grown in suitable placement sites.

Multiple Purpose Sites. There are some valuable, highly visible, and heavily used multiple purpose dredged material placement sites that include combinations of human habitation, commercial, and recreational use, fish and wildlife habitat, and shoreline protection/sediment stabilization. Mission Bay, Belle Isle, East Potomac Park, and Pointe Mouillee have already been previously mentioned. A number of other sites can meet these requirements and make such sites more attractive to both urban planners and natural resource managers, as well as be more cost-efficient in placement operations. Multiple purpose projects are projected to be the norm for most future dredged material placement sites.

Most confined disposal facilities lend themselves to

coast.

Pacific coast restoration/creation dredged material sites are quite different between California and the Pacific Northwest. In California, differences in precipitation, climate, and soil foundations also make significant differences between southern California salt marsh/lagoon restoration using dredged material and and northern California salt/brackish/fresh intertidal marsh in the San Francisco/Sacramento delta waterway systems. In southern California, for example, most substrates where dredged material is placed or excavated are sandy or cobbly and provide a firm foundation.

In contrast, in northern California, most dredged material contains large silt/clay fractions, and the soft foundation upon which it is placed is subsided peaty soil. Although all California dredged material wetlands tend to be planted in Pacific cordgrass and pickleweed, engineering techniques are quite different, and the resulting marshes and their utilization (biotic diversity and abundance) are much different. Wetlands in California also tend to have wildlife endangered species habitat restoration as goals, while Oregon/Washington wetlands emphasize benthos and fish use. Examples of successful dredged material use for wetland restoration/creation in California include Muzzi Marsh in Marin County, Salt Pond #3 and Warm Springs at Heyward, Boca Chica marsh near Long Beach, and Donlin Island and Venice Cut marshes in the San Joaquin River intertidal reaches; several large manmade marshes using dredged material to counteract subsidence are currently planned in San Francisco and San Pablo Bays, and to counteract excessive sedimentation and channel blockage at Batiquitos Lagoon near Carlsbad, CA.

In the Pacific Northwest, cordgrass is not a native plant, and the current invasion of smooth cordgrass from the Atlantic and Gulf coasts is creating a furor among ecologists concerned about displacement of food prey items for migrating salmon. Dredged material wetlands in the Pacific Northwest are planted with tufted hairgrass, slough sedge, Lyngbye's sedge, arrowgrass, and other native species. Eelgrass is intertidal in Oregon and Washington, and has been planted intertidally in Puget Sound on dredged material. Examples of successful wetland restoration/creation wetlands include Miller Sands in the lower Columbia River, OR, and Jetty Island and Lincoln Avenue in Puget Sound, WA.

Aquatic and Marine Habitats. While there are not as many aquatic and marine projects using dredged material as for other types of beneficial uses, such projects have been constructed using both experimental and tested design criteria. They have primarily been oyster bars, clam flats, lobster beds, fishing reefs, and seagrass beds. Most completed projects have consisted of bringing the water bottom up to a more habitat-conducive elevation, slope, and configuration using dredged material, then capping with rock, shell, cobble, or other coarse material that provide better habitat features. Successful examples include oyster bars in Chesapeake Bay, a lobster bed in Long Island Sound, fishing reefs in the Gulf of Mexico, Pacific and Atlantic Oceans, and Great Lakes, clam/mussel beds in the Tombigbee and Ohio

the more than 14,000 acres of confined placement sites in the Tennessee-Tombigbee Waterway that are planted and managed by the Corps either as waterfowl overwintering areas, bottomland hardwoods, mixed shrub/tree stands, or other habitats for wildlife. It also does not include such historic sites such as the 39-year-old bottomland hardwood forests that colonized on dredged material deposits in the West Pearl River, MS and LA, or the 60-yr-old dredged material islands in the James River, VA, that colonized with floodplain forests.

In coastal Louisiana, dredged material has been used since 1974 to nourish eroding and subsiding marshes by placing the dredge pipe heads over the natural berms and pumping material to an intertidal elevation, then moving the pipe and repeating the process. According to GIS information compiled by the Corps, the FWS National Wetlands Research Center, and Louisiana Department of Natural Resources, since 1956 the lower Mississippi River area below New Orleans has lost over 103,000 acres of wetlands. At the same time, since 1974 more than 8000 acres of new dredged material deposits have resulted in wetlands in various stages of development. This still leaves a huge deficit of wetland losses, and it is readily apparent that beneficially using dredged material is not the sole answer to wetland losses in coastal Louisiana.

A number of other coastal Louisiana wetland projects have been aided by dredged material applications. These include Wine Island (a new manmade barrier island), Queen Bess Island (additions to a waterbird nesting island), wetland restoration and shoreline stabilization along parts of the Gulf Mississippi River Outlet, and wetland restoration in the Atchafalaya Delta. Additional beneficial uses will be evaluated and/or undertaken in coastal Louisiana as dredging activities are carried out, including the possible construction of underwater berms for shoreline protection and nourishment, more wetlands, and other types of habitat development.

Wetlands have been restored or created in other Northern Gulf Coast locations besides Louisiana. These include fringe wetlands from Tampa Bay, FL, to below Corpus Christi, TX, and wetlands that accomplish three purposes: (a) stabilize sediment, (b) protect shorelines, and (c) create marsh. Examples include cordgrass marshes planted on the shorelines of the newest waterbird nesting islands in central Tampa Bay, cordgrass planted on the northwest dike of Gaillard Island in Mobile Bay and Coffee Island in Mississippi Sound (both dredged material islands), and cordgrass planted on at least ten dredged material locations in Galveston Bay, TX.

Wetland restoration/creation sites on the Atlantic coasts using dredged material are not as numerous as along the Gulf coast. However, there are over 70 wetlands constructed on dredged material from 1975-1990 from Chesapeake Bay to Cape Canaveral, FL. FL, that range in size from 0.5 acre to over 100 acres. Most were built using unconfined hydraulic placement of sandy material. Both "clean" and "mildy-contaminated" material have been successfully used for wetland restoration/creation on the Atlantic

Along the Upper Mississippi River, Columbia River, and other waterways, smaller parks, boat launching ramps, and other recreational facilities have been constructed using dredged material. The hundreds of thousands of recreational boats in the United States that are kept in local private and public marinas are also major utilizers of waterways. These marinas must dredge on a regular basis. As much as possible, they use the dredged material beneficially, although it has historically been more difficult for them to obtain permits for beneficial uses than for public agencies who dredge.

Natural Resource and Agricultural Uses

Nesting Islands. One of the earliest and most spectacular beneficial uses of dredged material has been over 2000 constructed islands that are home to approximately 1,000,000 nesting sea and wading birds (37 species), and that provide migratory and overwintering habitat for several hundred species of waterfowl, shorebirds, waterbirds, songbirds, and raptors. Use of these islands has been well documented over several decades. In the northern Gulf Coast where nearly 700 islands remain available for nesting, over half of them contain nesting colonies each year.

At the present time, few new islands are being built. However, because the older islands erode and change configuration over time, repairs and additions to existing dredged material islands is infrequently taking place. Where habitat types are scarce, some island construction continues. Most nesting waterbirds have adapted to using diked dredged material islands as well as undiked islands. In North Carolina, where most coastal waterbirds are nesting on dredged material, however, the construction of diked islands rather than nourishment of existing undiked islands has led to a concentration of nesting birds into fewer colonies that are more likely to be subject to catastrophic disturbance.

Upland Meadows and Forests. Many dredged material containment sites have been constructed since 1974, when the federal resource agencies began demanding that most dredged material be confined. Both prior to that time as undiked sites, and continuing now as diked areas, some meadows and forests have either been developed or have been allowed to colonize on upland dredged material areas. Many of these have remained relatively isolated and receive abundant wildlife use. An example is Nott Island, CT, which was built in 1975 by mixing silty dredged material with an existing sandy dredged material site, providing soil amendments (lime, fertilizer), and planting with grasses and legumes. That Connecticut River site remains a viable meadow and has never received post-project management. Other examples are a pine forest planted inside a sandy containment site at Slaughter Creek, Chesapeake Bay, MD, and a pine forest planted inside a sandy containment site near Winona, MI.

Wetlands. Over 60,000 acres of wetlands, both coastal and interior, have been restored or created in the United States using dredged material in the past two decades. This does not include

Examples of Beneficial Uses

Commercial, Industrial, and Urban Uses

Prior to 1970, most dredged material was being used for airports, port expansions, additional living space, and shopping and other commercial enterprises. LaGuardia, Washington National, Portland International, San Francisco International, San Diego International, and numerous other airports have dredged material bases. Likewise, nearly every major port facility in the nation has dredged material foundations. This is especially so for Portland, Oakland, Galveston, Houston, Los Angeles/Long Beach, New York, Philadelphia, and Baltimore. Both Galveston and Portland have hundreds of businesses and homes constructed on dredged material foundations. This type of beneficial use continues today where land expansion is acceptable and natural resources are not impacted.

Recreational Uses

Recreational facility and open space creation using dredged material has been practiced for a number of years; some city managers and water management offices are more cognizant of these opportunities than others. For example, East Potomac Park and nearby areas, including the Jefferson Memorial, are constructed on dredge and fill in the heart of Washington, DC.

Another example is Mission Bay in San Diego, CA, a large several hundred acre recreational complex constructed of dredged material which contains Sea World and numerous other recreational attractions. The park is also home to nesting endangered California least terns. Approximately 200 acres of eelgrass have been restored within the waters of Mission Bay Park. A similar example is Belle Isle in the Detroit River, between Detroit, MI, and Windsor, Ontario, Canada. Dredged material is temporarily contained and reused on Belle Isle on a regular basis to expand the recreational facilities, which include a zoo, botanical gardens, a beach, open space and ball fields, and numerous other recreational facilities.

A different type of recreational restoration using dredged material occurred in Vancouver, WA, when Lake Vancouver, a historic but sediment laden oxbow of the Columbia River, was restored by dredging the lake. This huge project was undertaken by the Port of Vancouver (Mr. Richard F. Gorini*, manager). The project from initiation to completion took nearly 10 years, with most of that time absorbed by coordination and regulations. The lake's dredged material was used for agricultural enrichment, island construction, beach nourishment, construction of an engineered flushing system to better maintain the dredged depths of the "new" lake, and recreational land.

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prepared a book on international beneficial uses of dredged material in 1992. The book, which contains chapters on aquatic, island, wetland, and other natural resources, as well as port, land expansion, and other uses, is available from the US Army Engineer Waterways Experiment Station (WES), Vicksburg, MS 39180-6199 USA, along with other technical documents and engineer manuals on dredged material beneficial uses.

North America

North American settlers began dredging river estuaries of the Atlantic and Gulf Coasts before the War for American Independence. Parts of the cities of Philadelphia, Baltimore, Washington, New York, Norfolk, Charleston, Savannah, Galveston, New Orleans, Mobile, and numerous other smaller coastal population centers were dredged using horse-pulled equipment (in later years, steam- and other types of engine-driven dredging equipment). This material was used to raise bank elevations, to create uplands and beaches, and to fill lowlands and estuaries. Until the turn of the century, almost all use of dredged material was for urban and industrial expansion.

By the 1890's, the US Army Corps of Engineers and the various major ports and cities of the nation were dredging to provide a 25,000-mile navigation system that was used to transport food, materials and products, and people both within the United States and as exports to the rest of the world. The Corps also has dredged to increase stream capacity for flood water management. While it is well known that dredging and filling was one of the manmade impacts that caused considerable disruption to natural ecosystems during those years, it is pertinent to also note that many habitat-related beneficial uses occurred secondary to project purpose.

For example, Jetty Island, a large island in Puget Sound, was constructed of dredged material in 1891 when the harbor was dredged to provide navigation facilities for Everett, WA. Subsequently, the island has been used for over 100 years by seabirds and other species for nesting, and has provided both wetland habitat and channel protection/stabilization for Everett as well as seasonal, supervised recreational day use for picnicking and bird watching. Dredged material islands on the Gulf and Atlantic coast have provided similar longevity, especially in Florida, North Carolina, and Texas where they have supported hundreds of thousands of nesting waterbirds since the early 1930's when the Intracoastal Waterway System was begun.

In the evolution of thinking by this nation's citizens, dredged sediments are now viewed as providing a resource foundation for the restoration, creation, and enhancement of natural and/or recreational sites such as wetlands and wildlife islands. Still further, planners and managers now consider and plan multiple purposes of large dredged material sites that include commercial and recreational facilities and activities, while still providing natural resource habitats. The evaluation and application of beneficial use of project dredged material is becoming more routine in most Corps District dredging programs.

CONCEPT, HISTORY, AND EXAMPLES OF BENEFICIAL USES OF DREDGED MATERIAL

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The Concept of Beneficial Uses of Dredged Material

To each of us, the concept of productive, or beneficial, uses of dredged material means something different, and a definition of beneficial uses of dredged material is simply utilizing dredged sediments as resource materials in productive ways. The beneficial use of dredged material is definitely in the eyes of the beholder. To urban managers, land use planners, and engineers, a beneficial use may mean new land open space, for parks, or for expansion of ports, airports, and other infrastructure foundations. To conservationists, a beneficial use would be the restoration or improvement of degraded or lost habitat, or the creation of scarce habitats, through placement of suitable dredged material in a soundly designed and implemented habitat development project.

Historical Aspects of Dredged Material Beneficial Uses

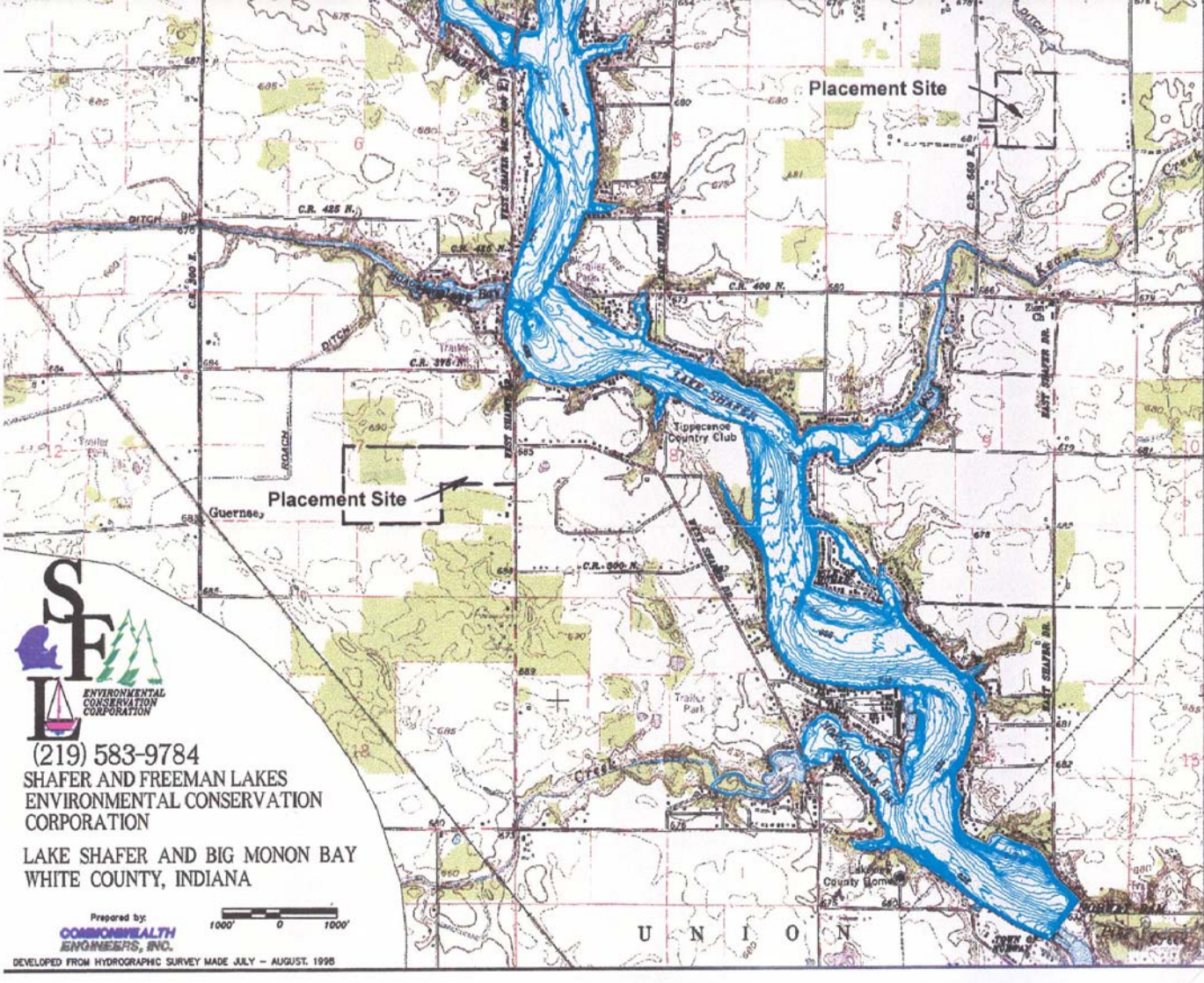
The World

Historically, dredged material has been beneficially used for over 2500 years on the coasts of Europe and Asia, and in the past 250 years on the coasts, rivers, and lakes of North America. The Phoenicians and Romans hand-dredged to deepen and maintain their ports and harbors in the Mediterranean Sea. The Chinese hand-dredged their river estuaries to maintain boat channels. Undoubtedly, any population of people who were sea-farers also faced this challenge and dealt with it in similar fashion.

In more modern times, the Dutch, French, Italians, British, Australians, Chinese, Japanese, Turks, Greeks, citizens of Hong Kong, and other nations use virtually all of their dredged sediments beneficially in ways generally not practiced in the United States. For example, the Dutch, Japanese, and British use dredged material for fast land creation to expand their land base for growing human populations. The Italians are involved in complex projects such as dredging coupled with providing flood gates for the City of Venice. The Australians and other nations dredge their estuaries to maintain international navigation.

The major dredging nations who belong to the Permanent International Association of Navigation Congresses (PIANC)


Placement Site
Sediment Removal Area
Sediment Removal Area
Placement Site
Sediment Removal Area
Sediment Removal Area
Placement Site
Placement Site
TIPPECANOE RIVER
MONON
LIBERTY
C.R. 700 N.
C.R. 800 N.
MONON RD.
LOVES RD.
STATE RD.
PARKER RD.
WILLIAMS
Bedford Cem
Hughes Cem
Trader Park
CARNAHAN DITCH
DITCH



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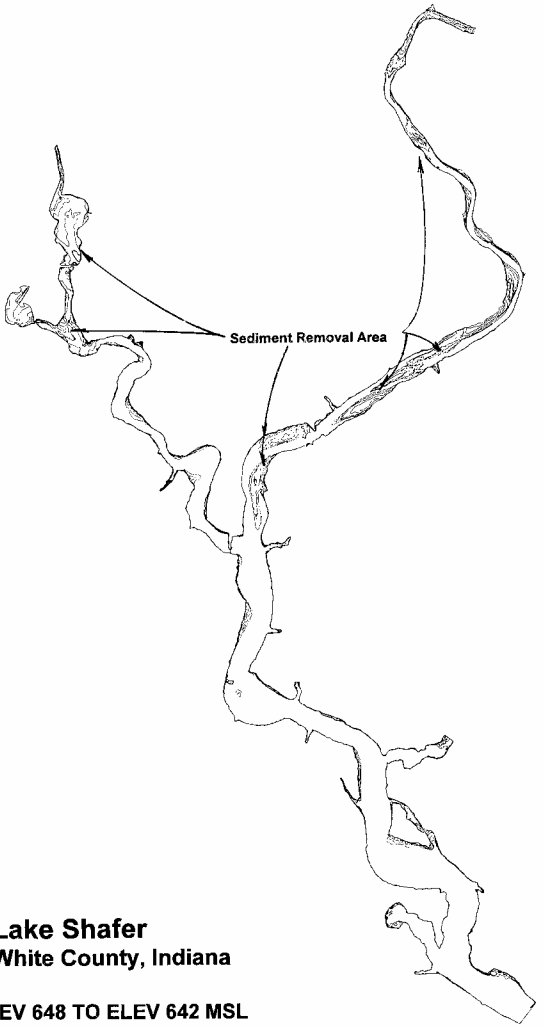

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White County, Indiana

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